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28 June 2000

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U.S. PTO

Attorney Docket: P56112

Sir:

Submitted herewith is the following patent application:

Inventor: 1) CHANG-ROK LEE
 2) CHUL-MIN KIM

Title: **FREQUENCY MODULATION (FM) RECORDING APPARATUS
OF VIDEO TAPE RECORDER**

Please find attached hereto an application for patent which includes: Specification and Abstract, Claims, original Declaration And Power of Attorney, Assignment, and a certified copy of the foreign priority document identified below:

Verified Showing of Small Entity Status: **NO**

Drawings: Formal drawings, 2 sheets, Figures 1-5

Claim of priority under 35 U.S.C. §119: **YES**

** The Republic Of Korea Application No. 46360/1999 filed on 25 October 1999.

FEE (see formula below): CHECK IS NOT ENCLOSED

Basic Fee \$345/690	<u>\$690.00</u>
Additional Fees:	
Total number of claims in excess of 20: <u>5</u> times \$9/18 .	<u>\$90.00</u>
Number of independent claims in excess of 3: <u> </u> times \$39/78	<u>\$0.00</u>
Multiple Dependent Claims \$130/260	<u>\$0.00</u>
An Assignment is likewise enclosed: Recording Fee \$40 . .	<u>\$0.00</u>
Filing Non-English specification	<u>\$0.00</u>
TOTAL FEES FOR THE ABOVE APPLICATION	<u>\$780.00</u>

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28 June 2000
Page Two

Docket No.: P56112

Inventor: 1) CHANG-ROK LEE
 2) CHUL-MIN KIM

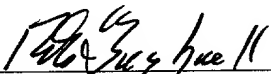
Title: **FREQUENCY MODULATION (FM) RECORDING APPARATUS
OF VIDEO TAPE RECORDER**

In view of the above, it is requested that this application be accorded a filing date pursuant to 37 CFR 1.53(b).

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Respectfully submitted,



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TITLE OF THE INVENTION

**FREQUENCY MODULATION (FM) RECORDING APPARATUS OF
VIDEO TAPE RECORDER**

CLAIM OF PRIORITY

This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application entitled *Frequency Modulation Recording Apparatus of Video Tape Recorder* earlier filed in the Korean Industrial Property Office on 25 October 1999, and there duly assigned Serial No. 99-46360 by that Office.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a video tape recorder, and more particularly, to a frequency modulation (FM) recording apparatus for recording FM-modulated video signals to video tapes.

Description of the Related Art

A video tape recorder performs frequency modulation upon a video signal and then records the frequency modulated video signal. In a double-deck video tape recorder, a signal reproduced in one deck can be recorded in the other deck. In this case, an FM signal reproduced by a header in one deck (henceforth to be referred to as a Playback (PB)-FM signal) is pre-processed and supplied to

1 the other deck. Here, pre-processing involves image enhancement equalizing of the playback
2 frequency modulated signal.

3 The frequency modulation recording device of a video tape recorder receives a PB-FM signal
4 and generates a recording FM signal (REC-FM signal). The REC-FM signal is recorded after
5 passing through an equalizer and a recording header.

6 The recording device has a drawback in that the apparatus cannot properly compensate for
7 an imbalance between channels. That is, if there is a difference in the response characteristics of the
8 header of one channel and the header of a second channel, the levels of the signals they reproduce
9 respectively, will be uneven. In addition, there is a problem of noise flowing into the REC-FM
10 signal through the processing steps of the PB-FM signals.

11 Exemplars of the art, U.S. Patent 5,552,895 for *Double-deck Magnetic*
12 *Recording/Reproducing Apparatus* by Kim, U.S. Patent 4,641,206 for *Video Signal Recording and*
13 *Reproducing Apparatus Including a Noise Reduction Circuit* issued to Iwafune, U.S. Patent
14 5,075,803 for *Signal Discriminating Device for VTR having Expanded Dynamic Range* issued to
15 Moro, et al., U.S. Patent 5,194,963 for *Dual Deck Videocassette Recorder System* issued to Dunlap,
16 et al., U.S. Patent RE36,339 for *Circuit for Tape Duplication in Video Tape Recorder* issued to Yun,
17 et al., U.S. Patent 3,947,873 for *Method and Circuit for Detecting and Compensating for Drop-out*
18 *and Distortion of Frequency Modulated Video Signals* issued to Buchan, U.S. Patent 5,034,823 for
19 *Drop-out Compensation Circuit* issued to Geerlings disclose frequency modulated video recording
20 circuits. I have noticed that the art does not show a frequency modulated video recorder that can

1 control the video channel balance while reducing noise in order to provide a high fidelity recording.

2 SUMMARY OF THE INVENTION

3 To solve the above problems, it is an objective of the present invention to provide a recorder
4 for recording FM-modulated video signal with high resolution.

5 It is another object to provide an FM video signal recorder that can compensate for an
6 imbalance between channels.

7 It is yet another object to provide a video signal recorder that prevents noise from flowing
8 into a recording signal.

9 It is still another object to improve the response characteristics of the components used to
10 process a frequency modulated signal for recording in a video recorder.

11 To accomplish the above object of the present invention, there is provided a frequency-
12 modulation recording apparatus for recording a frequency modulation video signal having luminance
13 and color components onto a recording medium. The FM recording apparatus has an automatic gain
14 controller for equalizing the level of the FM modulated video signal; a limiter for limiting the level
15 of the luminance components of the FM signal output from the automatic gain controller; a recording
16 equalizer for equalizing the output of the limiter in accordance with the characteristics of the
17 recording medium; a color low-pass filter for filtering and transmitting the color component of the
18 FM modulated video signal output from the automatic gain controller; and a mixer for mixing the
19 luminance component output from the recording equalizer with the color component output from

the color low-pass filter.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of this invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

FIG. 1 is a block diagram showing the structure of an FM recording apparatus;

FIG. 2 is a block diagram showing the structure of an FM recording apparatus according to the present invention;

FIG. 3A and 3B are schematic diagrams showing the operation of the automatic gain controller of FIG. 2;

FIG. 4 is a waveform showing the operation of the Direct Chroma Controller (DCC) of FIG. 2; and

FIG. 5 is a block diagram showing the structure of the DCC of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings, as seen in FIG. 1 the recording device receives a PB-FM signal 120 and generates a recording FM signal (REC-FM signal) 126. The REC-FM signal 126 is recorded after passing through an equalizer and a recording header (not shown). The apparatus of

FIG. 1 includes a playback equalizer 102, a drop out detector (DOD) 104, a switch 106, a limiter 108, a recording equalizer 110, a color band pass filter 112 and a mixer 114.

The playback equalizer 102 equalizes phase characteristics of a PB-FM signal 120, and removes the color component using a color trap. The drop out detector 104 detects the dropped-out portion of the PB-FM signal. The switch 106 switches to ground 124 if the drop out detector 104 detects a dropped-out signal. The reason for this is that the reproducing side can compensate for a signal drop out by a drop out compensator when the recording side does not perform drop out compensation. That is, even if an FM signal that has a dropped-out portion, is recorded, the dropped-out portion is compensated for by a drop out compensator on the reproducing side. Therefore, by setting the dropped-out portion of a signal at ground from the beginning, the drop out compensation can be easily performed on the reproducing side.

The limiter 108 restricts the level of a PB-FM signal to a predetermined level. The recording equalizer 110 equalizes a PB-FM signal supplied from the limiter 108 according to the characteristics of a recording medium.

The color band-pass filter 112 filters and transmits an FM-modulated color component from a PB-FM signal 120. A luminance component from the recording equalizer 110 and a color component from the color band-pass filter 112 are mixed in the mixer 114 and sent to a recording amplifier and a recording head (not shown in drawings) as a recording FM signal (REC-FM signal) 126.

The apparatus of FIG. 1 has a drawback in that the apparatus cannot properly compensate

1 for an imbalance between channels. If there is a difference in the response characteristics of the
2 channel one header (CH1) and the channel two header (CH2), the levels of the signals they
3 reproduce respectively, will be uneven.

4 In addition, since the switch 106 is located in front of the limiter 108, even if the level of a
5 dropped-out signal goes to ground, noise from the operation of the limiter 108 and the recording
6 equalizer 110 still flows into the mixer 114.

7 Referring to FIG. 2, the recording apparatus according to the present invention includes an
8 automatic gain controller 202, a playback equalizer 204, a drop out detector 206, a limiter 208, a
9 recording equalizer 210, a switch 212, a color low-pass filter 214, a color killer 216, a mixer 218,
10 and a Direct Chroma Controller 220. The automatic gain controller 202 equalizes the signal level
11 of an input PB-FM signal 120 and evens out a PB-FM signal 120 whose levels are uneven between
12 channels.

13 FIG. 3A shows a PB-FM signal input to the automatic gain controller 202, and FIG. 3B
14 shows a PB-FM signal output from the automatic gain controller 202. As shown on the FIG. 3A,
15 a level difference (ΔV) occurs between portions reproduced by channel one (CH1) and by channel
16 two (CH2). This level difference (ΔV) is attributed to a difference in the response characteristics
17 of the CH1 header and the CH2 header. By equalizing the levels of the PB-FM output signal, the
18 automatic gain controller 202 eventually removes any uneven signal level portions. FIG. 3B shows
19 the PB-FM signal output 122 from the automatic gain controller 202 having the same level between
20 channel one CH1 and channel two CH2.

1 The playback equalizer 204 equalizes the phase characteristics of a PB-FM signal, and
2 removes the color component by the use of a color trap. The limiter 208 limits the level of a PB-FM
3 signal, and the recording equalizer 210 equalizes a PB-FM signal in accordance with the
4 characteristics of recording tapes.

5 The drop out detector 206 detects the occurrence of a drop out in a PB-FM signal from the
6 playback equalizer 204. If the presence of a dropped-out signal is determined, the switch 212 is
7 switched to ground 124. Since the apparatus of FIG. 2 has a switch 212 positioned after the
8 recording equalizer 208, the apparatus reduces the possible flow of noise into the mixer by removing
9 the limiter 208 and the recording equalizer 210 from the circuit when the switch 212 is grounded
10 124.

11 The color low-pass filter 214 filters and transmits the color component of a PB-FM signal,
12 and the color killer 216 removes the color component when a drop out in a PB-FM signal is detected
13 by the drop out detector 206, or when the level of the color component is too low or a monochrome
14 image is recorded.

15 The mixer 218 mixes and outputs a luminance component and a color component.

16 The DCC 220 is for reducing the response time of the automatic gain controller 202 and
17 generates an impulse signal synchronized to a head switching pulse.

18 Referring to the apparatus of FIG. 2, the operation of the automatic gain controller 202
19 stabilizes after an input signal is approved. That is, the response time of the automatic gain
20 controller 202 is slower than the rising time of an input signal. Therefore, the operation of the

1 automatic gain controller 202 for an FM color signal is not carried out properly. In order to
2 compensate for this, an additional circuit at the back of the automatic gain controller 202 is desired,
3 but the structure of such a circuit would be complicated and burdensome.

4 In order to solve this problem, the present invention uses a method in which the gain of the
5 automatic gain controller 202 is raised instantaneously the moment an input signal is approved. By
6 doing so, the response time of the automatic gain controller 202 becomes faster, and eventually the
7 operation of automatically controlling the gain of a color signal is improved.

8 FIG. 4 is a waveform showing the operation of the Direct Chroma Controller (DCC) 220 of
9 FIG. 2. On the upper part of FIG. 4 is a head switching pulse 134 and on the lower part of FIG. 4
10 is an impulse signal 136 generated by the DCC 220.

11 As shown in FIG. 4, the DCC 220 generates impulse signals 136 which coincide with the
12 rising and falling of the head switching pulses 134. The impulse signal 136 is approved to a node
13 which controls the degree of amplification of the automatic gain controller 202, and instantaneously
14 raises the amplification. As a result, the response time of the automatic gain controller 202 in the
15 rising portion and falling portion of an input signal becomes faster.

16 Referring to FIG. 5, the DCC 220 includes a delay 502 which delays the head switching
17 signal (HD_SW) 144 to a predetermined time, and an EXCLUSIVE-OR gate 504 which performs
18 an exclusive-or operation on the original head switching signal (HD_SW) 144 and the delayed head
19 switching signal. The output 150 from the exclusive OR operation goes to the automatic gain
20 controller (AGC).

1 As described above, the FM recorder according to the present invention adopts an automatic
2 gain controller for correcting an imbalance in the PB-FM signal levels of two channels and enables
3 FM recording with superior image. In addition, the FM recorder places a switch for processing a
4 drop out at the back of a recording equalizer, which prevents noise from a limiter and a recording
5 equalizer from flowing into a recording signal. Further, the FM recorder according to the present
6 invention applies a Direct Chroma Controller (DCC), to improve the response characteristics of an
7 automatic gain controller.

8 Although the preferred embodiments of the present invention have been disclosed for
9 illustrative purposes, those skilled in the art will appreciate that various modifications, additions and
10 substitutions are possible, without departing from the scope and spirit of the invention as disclosed
11 in the accompanying claims.

What is claimed is:

1. A frequency modulation (FM) recording apparatus, comprising:

an automatic gain controller equalizing a level of a frequency modulated video signal, the frequency modulated video signal having luminance and color components, the frequency modulated video signal being recorded on a recording medium;

a limiter preventing a level of the luminance components of the frequency modulated signal output from said automatic gain controller from exceeding a predetermined value;

a recording equalizer equalizing an output of said limiter in accordance with the characteristics of the recording medium;

a color low-pass filter filtering and transmitting the color component of the frequency modulated video signal output from said automatic gain controller; and

a mixer combining the luminance component output from said recording equalizer with the color component output from said color low-pass filter.

2. The frequency modulation recording apparatus of claim 1, further comprising:

a drop out detector recognizing a presence of a signal drop out in the frequency modulated signal output from said automatic gain controller;

a switch being positioned between said recording equalizer and said mixer and being controlled by said drop out detector, said switch passing the signal output from said recording

equalizer to said mixer if said drop out detector determines that a drop out does not exist and said switch passing a predetermined level signal to said mixer if the drop out detector determines the presence of a drop out.

3. The frequency modulation recording apparatus of claim 2, with the predetermined level being ground.

4. The frequency modulation recording apparatus of claim 1, further comprising a color killer being placed between said color low-pass filter and said mixer, said color killer terminating a color component if said drop out detector determines a signal drop out.

5. The frequency modulation recording apparatus of claim 4, with said color killer removing the color component when a level of color is below a predetermined value or when a monochrome image is being recorded.

6. The frequency modulation recording apparatus of claim 1, further comprising a Direct Chroma Controller (DCC) increasing a degree of amplification of said automatic gain controller on a rising part and a falling part of a reproduced frequency modulated signal.

7. The frequency modulation recording apparatus of claim 1, with said Direct Chroma

Controller comprising:

a delay unit receiving a head switching signal and delaying the head switching signal for a predetermined time; and

an exclusive OR gate performing an exclusive OR operation on the head switching signal and the delayed head switching signal output from the delay, the output from the exclusive OR gate being approved to an amplification control terminal of said automatic gain controller and the degree of amplification of said automatic gain controller being adjusted on both a rising portion and a falling portion of a head switching pulse.

8. The frequency modulation recording apparatus of claim 1, further comprising a color low pass filter separating and transmitting the color component of the frequency modulated signal output from said automatic gain controller.

9. The frequency modulation recording apparatus of claim 1, with said automatic gain controller instantaneously raising a gain of the inputted frequency modulated video signal when the inputted frequency modulated video signal is approved.

10. The frequency modulation recording apparatus of claim 1, with said direct chroma controller reducing the response time of said automatic gain controller and generating an impulse signal synchronized to a head switching pulse, said direct chroma controller generating impulse

4 signals coinciding with a rising and falling of the head switching pulses, the impulse signal being
5 approved to a node controlling a degree of amplification of said automatic gain controller and
6 instantaneously raising the amplification.

1 11. A frequency modulation (FM) recording apparatus, comprising:

2 an automatic gain controller equalizing a level of a frequency modulated video signal, the
3 frequency modulated video signal having luminance and color components, the frequency modulated
4 video signal being recorded on a recording medium;

5 a playback equalizer removing the color component by a color trap and equalizing a phase
6 characteristics of the frequency modulated video signal outputted from said automatic gain
7 controller;

8 a drop out detector recognizing a presence of a signal drop out in the frequency modulated
9 signal output from said playback equalizer;

10 a limiter preventing a level of the luminance components of the frequency modulated signal
11 output from said playback equalizer from exceeding a predetermined value;

12 a recording equalizer equalizing an output of said limiter in accordance with the
13 characteristics of the recording medium;

14 a switch removing said limiter and said recording equalizer when said drop out detector
15 detects a presence of the signal drop out in the frequency modulated signal;

16 a color low-pass filter filtering and transmitting the color component of the frequency

modulated video signal output from said automatic gain controller; and

a mixer combining the luminance component output from said recording equalizer with the color component output from said color low-pass filter, the removal of said limiter and said recording equalizer by said switch reducing a flow of noise into said mixer.

12. The apparatus of claim 11, with said switch being positioned between said recording equalizer and said mixer and being controlled by said drop out detector, said switch passing the signal output from said recording equalizer to said mixer if said drop out detector determines that a drop out does not exist and said switch passing a predetermined level signal to said mixer if the drop out detector determines the presence of a drop out.

13. The frequency modulation recording apparatus of claim 12, with the predetermined level being ground.

14. The frequency modulation recording apparatus of claim 13, further comprising a color killer being placed between said color low-pass filter and said mixer, said color killer terminating a color component if said drop out detector determines a signal drop out.

15. The frequency modulation recording apparatus of claim 14, with said color killer removing the color component when a level of color is below a predetermined value or when a

monochrome image is being recorded.

16. The frequency modulation recording apparatus of claim 15, further comprising a direct chroma controller (DCC) increasing a degree of amplification of said automatic gain controller on a rising part and a falling part of a reproduced frequency modulated signal.

17. The frequency modulation recording apparatus of claim 16, with said direct chroma controller comprising:

a delay unit receiving a head switching signal and delaying the head switching signal for a predetermined time; and

an exclusive OR gate performing an exclusive OR operation on the head switching signal and the delayed head switching signal output from the delay, the output from the exclusive OR gate being approved to an amplification control terminal of said automatic gain controller and the degree of amplification of the automatic gain controller being adjusted on both a rising portion and a falling portion of a head switching pulse.

18. The frequency modulation recording apparatus of claim 17, further comprising a color low pass filter separating and transmitting the color component of the frequency modulated signal output from said automatic gain controller.

1 19. The frequency modulation recording apparatus of claim 18, with said automatic gain
2 controller instantaneously raising a gain of the inputted frequency modulated video signal when the
3 inputted frequency modulated video signal is approved.

1 20. The frequency modulation recording apparatus of claim 19, with said direct chroma
2 controller reducing the response time of said automatic gain controller and generating an impulse
3 signal synchronized to a head switching pulse, said direct chroma controller generating impulse
4 signals coinciding with a rising and falling of the head switching pulses, the impulse signal being
5 approved to a node controlling a degree of amplification of said automatic gain controller and
6 instantaneously raising the amplification.

1 21. A method of processing a frequency modulated (FM) signal for recording, comprising
2 the steps of:

3 equalizing a level of a frequency modulated video signal by an automatic gain controller, the
4 frequency modulated video signal having luminance and color components, the frequency modulated
5 video signal being recorded on a recording medium, said automatic gain controller instantaneously
6 raising a gain of the inputted frequency modulated video signal when the inputted frequency
7 modulated video signal is approved;

8 removing the color component by a color trap and equalizing a phase characteristics of the
9 frequency modulated video signal outputted from said automatic gain controller by a playback

equalizer;

recognizing a presence of a signal drop out in the frequency modulated signal output from said playback equalizer by a drop out detector;

preventing a level of the luminance components of the frequency modulated signal output from said playback equalizer from exceeding a predetermined value by a limiter;

equalizing an output of said limiter in accordance with the characteristics of the recording medium by a recording equalizer;

removing said limiter and said recording equalizer when said drop out detector detects the presence of the signal drop out in the frequency modulated signal by a switch;

filtering and transmitting the color component of the frequency modulated video signal output from said automatic gain controller by a color low-pass filter; and

combining the luminance component output from said recording equalizer with the color component output from said color low-pass filter by a mixer, the removal of said limiter and said recording equalizer by said switch reducing a flow of noise into said mixer.

22. The method of claim 21, with said switch being positioned between said recording equalizer and said mixer and being controlled by said drop out detector, said switch passing the signal output from said recording equalizer to said mixer if said drop out detector determines that a drop out does not exist and said switch passing a ground signal to said mixer if the drop out detector determines the presence of a drop out.

1 23. The method of claim 22, further comprising the steps of:

2 placing a color killer between said color low-pass filter and said mixer;

3 terminating by said color killer the color component of the frequency modulated video signal
4 from said color low-pass filter if said drop out detector determines a signal drop out, said color killer
5 removing the color component when a level of color is below a predetermined value or when a
6 monochrome image is being recorded;

7 increasing a degree of amplification of said automatic gain controller on a rising part and a
8 falling part of a reproduced frequency modulated signal by a direct chroma controller (DCC); and

9 a color low pass filter separating and transmitting the color component of the frequency
10 modulated signal output from said automatic gain controller.

11 24. The method of claim 23, with said step of increasing the degree of amplification of
12 said automatic gain controller by said direct chroma controller, further comprising the steps of:

13 receiving and delaying a head switching signal by a delay unit, said delay unit delaying the
14 head switching signal for a predetermined time; and

15 performing an exclusive OR operation on the head switching signal with an exclusive OR
16 gate and the delayed head switching signal output from the delay, the output from the exclusive OR
17 gate being approved to an amplification control terminal of said automatic gain controller and the
18 degree of amplification of the automatic gain controller being adjusted on both a rising portion and

9 a falling portion of a head switching pulse.

1 25. The method of claim 24, with said direct chroma controller reducing the response
2 time of said automatic gain controller and generating an impulse signal synchronized to a head
3 switching pulse, said direct chroma controller generating impulse signals coinciding with a rising
4 and falling of the head switching pulses, the impulse signal being approved to a node controlling a
5 degree of amplification of said automatic gain controller and instantaneously raising the
6 amplification.

Abstract of the Disclosure

A frequency modulation (FM) recording apparatus for recording an FM modulated video signal onto a recording medium is provided. This recording apparatus (luminance components plus color components) includes an automatic gain controller; a limiter for limiting the level of a luminance component output from the automatic gain controller; a recording equalizer for equalizing the output from the limiter in accordance with the characteristics of the recording medium; a color low-pass filter for filtering and transmitting a color FM signal in an FM modulated video signal output from the automatic gain controller; and a mixer for mixing the luminance component output from the recording equalizer with the color component output from the color low-pass filter. The FM recording apparatus adopts an automatic gain controller for correcting an imbalance in the levels of playback FM signals between channels, and enabling FM recording with superior image.

FIG. 1

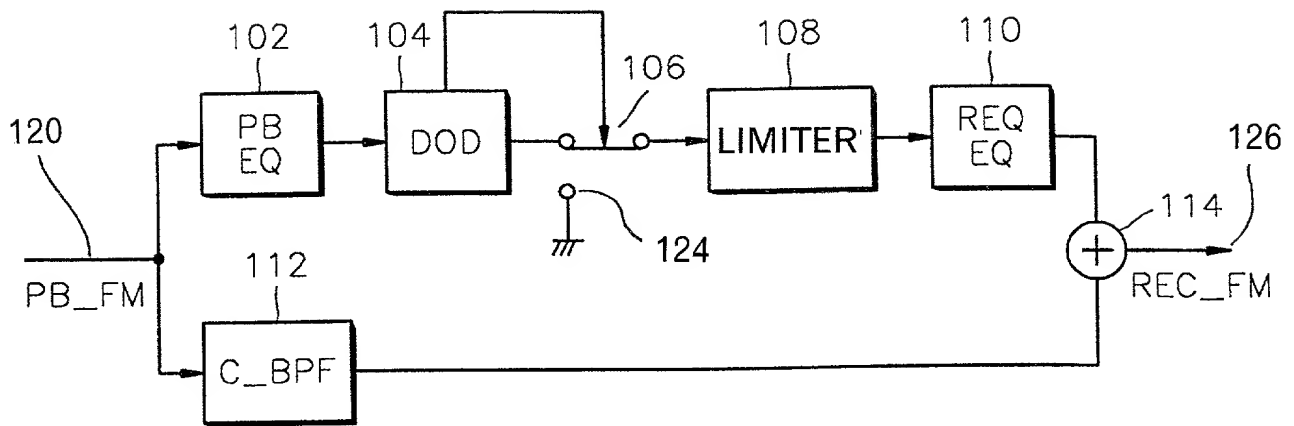


FIG. 2

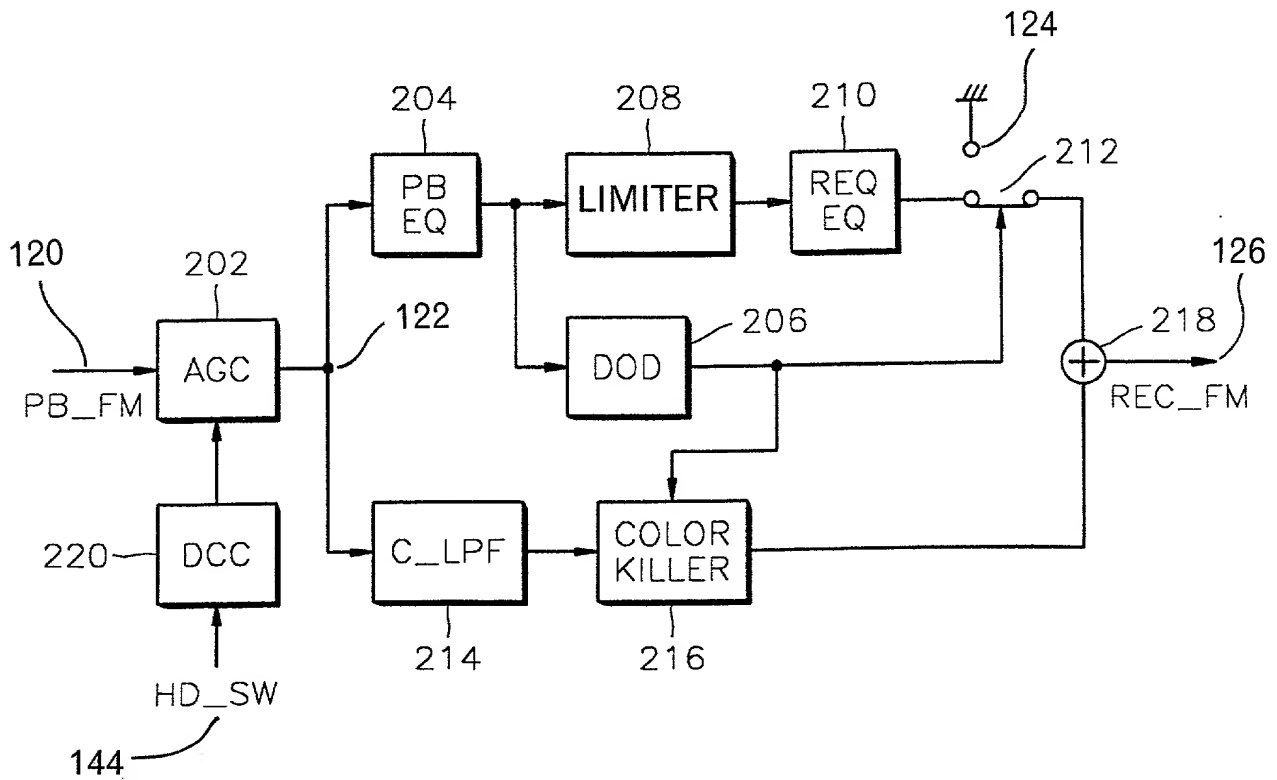


FIG. 3A

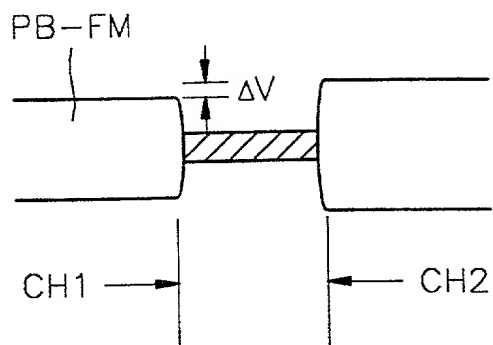


FIG. 3B

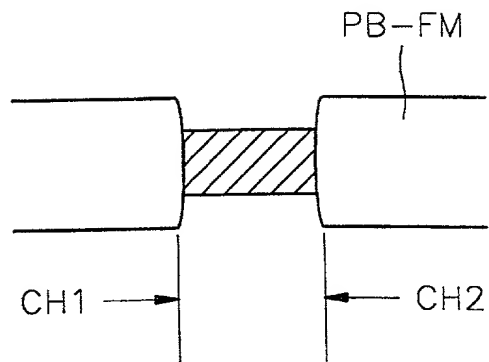


FIG. 4

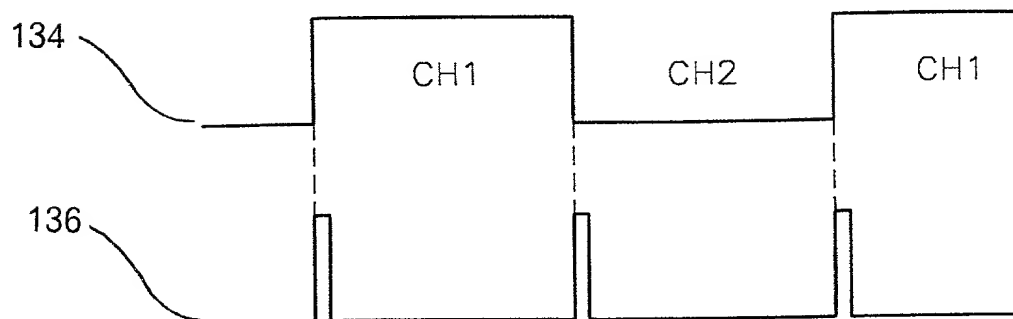
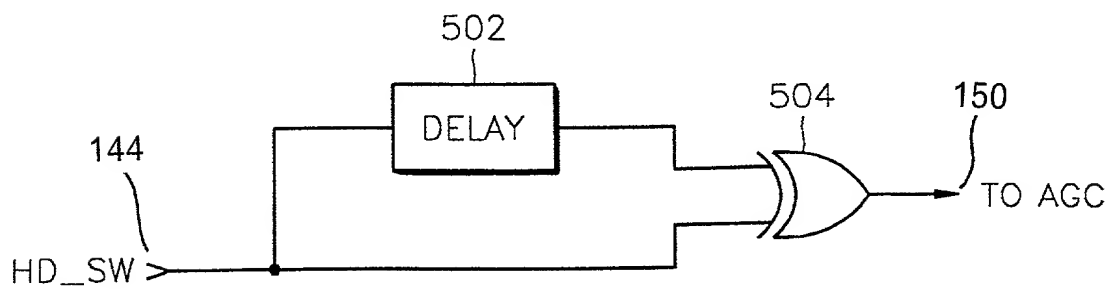


FIG. 5



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

CHANG-ROK LEE et al.

Serial No.: *To be assigned*

Examiner: *To be assigned*

Filed: 28 June 2000

Art Unit: *To be assigned*

For: FREQUENCY MODULATION (FM) RECORDING APPARATUS OF VIDEO
TAPE RECORDER


TRANSMITTAL OF DECLARATION

Assistant Commissioner
for Patents
Washington, D.C. 20231

Sir:

This transmittal accompanies an unexecuted Declaration for the above-captioned application. An executed Declaration will be filed upon receipt of the Serial No. for the above-captioned application.

Respectfully submitted,


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Date: 6/28/00
I.D.: REB/sb

AS A BELOW NAMED INVENTOR, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe that I am the original, first and sole (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below), of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE: *FREQUENCY MODULATION (FM) RECORDING APPARATUS OF VIDEO TAPE RECORDER*

the specification of which either is attached hereto or otherwise accompanies this Declaration, or:

☐ was filed in the U.S. Patent & Trademark Office on _____ and assigned Serial No. _____

☐ and (if applicable) was amended on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability and to the examination of this application in accordance with Title 37 of the Code of Federal Regulations § 1.56. I hereby claim foreign priority benefits under Title 35, U.S. Code § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, or § 119(e) of any United States provisional application(s), listed below and have also identified below any foreign applications for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>46360/1999</u>	<u>Republic of KOREA</u>	<u>25 October 1999</u>	Priority Claimed:
(Application Number)	(Country)	(Day/Month/Year filed)	Yes [X] No []

_____ (Application Number)	_____ (Country)	_____ (Day/Month/Year filed)	Yes [] No []
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_____ (Application Number)	_____ (Country)	_____ (Day/Month/Year filed)	Yes [] No []
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I hereby claim the benefit under Title 35, U.S. Code, § 120, of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, U.S. Code, § 112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, The Code of Federal Regulations, § 1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (STATUS: patented, pending, abandoned)
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_____ (Application Serial No.)	_____ (Filing Date)	_____ (STATUS: patented, pending, abandoned)
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I hereby revoke all previously granted powers of attorney and appoint the following attorneys: Robert E. Bushnell, Reg. No. 27,774, Michael D. Parker, Reg. No. 34,973, and Darren R. Crew, Reg. No. 37,806, to prosecute this application and to transact all business in the U.S. Patent & Trademark Office connected therewith and with any divisional, continuation, continuation-in-part, reissue or re-examination application, with full power of appointment and with full power to substitute an associate attorney or agent, and to receive all patents which may issue thereon, and request that all correspondence be addressed to:

Robert E. Bushnell,

Attorney-at-Law

Suite 300, 1522 "K" Street, N.W.

Washington, D.C. 20005-1202

Payor No. 008439

Area Code: 202-408-9040

I HEREBY DECLARE that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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FULL NAME OF THIRD JOINT INVENTOR: _____

Citizenship: _____

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Date: _____

Residence & Post Office Address: _____

FULL NAME OF FOURTH JOINT INVENTOR: _____

Citizenship: _____

Inventor's signature: _____

Date: _____

Residence & Post Office Address: _____